PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference TS 7609 PCT	**FOR FURTHER ACTION**	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/EP 03/03927	International filing date *(day/month/year)* 15.04.2003	Priority date *(day/month/year)* 15.04.2002
International Patent Classification (IPC) or both national classification and IPC C10L1/08		
Applicant SHELL INTERNATIONALE RESEARCH MAATS... et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 3 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the opinion
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
13.11.2003	19.03.2004
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer Keipert, O Telephone No. +49 89 2399-7375

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/EP 03/03927

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:

Description, Pages

1, 3-11	as originally filed
2	received on 18.02.2004 with letter of 18.02.2004

Claims, Numbers

1-7	received on 18.02.2004 with letter of 18.02.2004

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).

   ☐ the language of publication of the international application (under Rule 48.3(b)).

   ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   ☐ contained in the international application in written form.

   ☐ filed together with the international application in computer readable form.

   ☐ furnished subsequently to this Authority in written form.

   ☐ furnished subsequently to this Authority in computer readable form.

   ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

   ☐ the description, pages:

   ☐ the claims, Nos.:

   ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

   (Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-7
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-7
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-7
	No:	Claims	

2. Citations and explanations

see separate sheet

Re Item V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Reference is made to the following documents:

   D1: COOKSON D J, SMITH B E: 'Observed and Predicted Properties of Jet and Diesel Fuels Formulated from Coal Liquefaction and Fischer-Tropsch Feedstocks' ENERGY & FUELS, vol. 6, 1992, pages 581-585, XP001096350
   D2: US-A-2002/020107
   D3: US-A-6 056 793
   D4: WO-A-00 60029

2. The application claims a method for improving cetane number by blending a Fischer-Tropsch gas oil and a petroleum-derived diesel fuel, whereby the volume amount of Fischer-Tropsch gas oil used for blending is smaller than the volume amount that would be required if a linear blending relationship was assumed. The associated technical effect is a positive deviation from a linear relationship (synergy) between volume fractions of the two components and the cetane number.

3. Of the prior art (see the passages cited in the international search report), documents D1 and D2 suggest a linear blending relationship. Document D3 suggests that a non-linear blending relationship, i.e. a positive deviation from a linear blending rule, might exist. However, D3 pertains to Fischer-Tropsch/biodiesel blends, as distinct from petroleum products. Document D4 shows a negative deviation from linearity when diesel and a light, low cetane Fischer-Tropsch naphtha is blended.

4. Nothing in the prior art suggests that, regarding the cetane number of a petroleum gasoil/Fischer-Tropsch gasoil blend, a positive deviation from a linear blending rule might exist. The obtained higher cetane numbers are therefore unexpected. Consequently, the subject matter of claim 1 and the claims depending on it are both novel and inventive (Article 33 PCT).

WO-A-0183648, one would conclude linear blending rules with regard to cetane number.

If one intends to increase the cetane number of a petroleum derived gas oil by blending with a Fischer-Tropsch derived gas oil and one assumes linear blending rules one can calculate the required volume of Fischer-Tropsch gas oil to be added.

A problem with Fischer-Tropsch derived gas oil is that they are not widely available and that the cost of preparing such gas oils is believed to be higher than the cost of preparing petroleum derived gas oil for the foreseeable future. There is thus a continuous drive to minimize the amount of Fischer-Tropsch derived gas oil in such a blend while meeting the different final product specifications.

Applicants have now surprisingly found the following more optimised method to upgrade a petroleum derived gas oil to a gas oil blend having a target cetane number using Fischer-Tropsch derived gas oil.

Method to increase the cetane number of a gas oil product based on a petroleum derived gas oil to a target cetane number Y by adding to the petroleum derived gas oil a volume amount of a Fischer-Tropsch derived gas oil having a higher cetane number, B, than the petroleum derived gas oil of cetane number, A, wherein the volume amount of added Fischer-Tropsch derived gas oil is less than the volume amount which would be added if linear blending is assumed.

Applicants have surprisingly found that the cetane number of a blend of petroleum derived gas oil and Fischer-Tropsch derived gas oil, in contrast to general opinion, cannot be determined by making use of linear blending assumptions. In contrast the addition of a certain volume of Fischer-Tropsch derived gas oil to a

AMENDED SET OF CLAIMS

1. Method to increase the cetane number of a gas oil product based on a petroleum derived gas oil to a target cetane number Y by adding to the petroleum derived gas oil a volume amount of a Fischer-Tropsch derived gas oil having a higher cetane number, B, than the petroleum derived gas oil of cetane number, A, wherein the volume amount of added Fischer-Tropsch derived gas oil is less than the volume amount which would be added if linear blending is assumed.

2. Method according to claim 1, wherein the volume fraction of Fischer-Tropsch gas oil is less than x, wherein x is the volume fraction that would be added if linear blending assumptions would have been made according to the following equation:

$$Y = A + x(B-A),$$

3. Method according to any one of claims 1 or 2, wherein a volume fraction x is added as Fischer-Tropsch derived gas oil in order to increase the cetane number to target value Y, wherein Y and x are related according to the following equation:

$$Y = A + (B-A)(-px^2 + qx),$$

where p and q are constants such that $1.4 > q > 1.9$ and $p = q-1$ and wherein A is the cetane number of the petroleum derived gas oil and B the cetane number of the Fischer-Tropsch derived gas oil.

4. Method according to claim 3 wherein, x is greater than 0.02 and less than 0.7.

5. Method according to claim 4, wherein x is less than 0.5.

6. Method according to any one of claims 1-5, wherein the cetane number, A, of the petroleum derived gas oil is greater than 40 and less than 70.

7. Method according to any one of claims 1-6, wherein the cetane number of the petroleum derived gas oil is measured by making use of near infrared spectroscopy.